

Please add new Claims 11-14, corresponding to subject matter from Claims 4, 5, 8 and 9, as follows:

~~11. (New) A method for refining a micro-structure of a metallic material,~~
comprising:
forming cavities in molten metal by direct application of a high-energy vibrating force including one of an electromagnetic vibrating force and an ultrasonic vibrating force to the molten metal; and

crushing into small pieces, via impact pressure generated during collapse of the cavities, solid particles of metals ^{dispersed in} other than the molten metal to yield a refined micro-structure of the other metals.

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12. (New) The method of Claim 11, wherein the crushing step includes crushing into small pieces the solid particles of the metals other than the molten metal including at least one of inter-metallic compounds dispersed in the molten metal and solid metal formed during solidification of the molten metal.

13. (New) The method of Claim 11, wherein the crushing step includes crushing into small pieces the solid particles of the metals other than the molten metal including at least one of solid particulate ceramics dispersed in the molten metal, nonmetals dispersed in the molten metal and solid metal formed during solidification of the molten metal.

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14. (New) The method of Claim 11, further comprising:
refining the other metals to shift the other metals to a periphery of the molten metal via simultaneous imposition of an electric current and a magnetic field on the molten metal during solidification of the molten metal.

IN THE ABSTRACT OF THE DISCLOSURE

Please amend the abstract, as follows:

Page 20, ~~delete~~ in its entirety and ~~substitute~~ therefor:

ABSTRACT OF THE DISCLOSURE

25 A method for refining a micro-structure of a metallic material includes forming cavities in molten metal by application of a high-energy vibrating force to the molten metal during a process of solidification. The newly formed solid crystal particles are then crushed by an impact pressure generated during a collapse of the cavities to refine the micro-structure of the material. High-energy electromagnetic vibrating force is then applied to a solidifying metal sample (10) by simultaneous imposition of an electric current and a magnetic field in an apparatus including an electromagnet (12) for applying a stationary magnetic field and an electrode (11) for passing an alternating current through the metal sample. In this way, solid crystal particles are crushed into small pieces, yielding a fine micro-structure thereof.--